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U1S S1405 S1700 S1707 S1708

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(58) Field of search
UK CL (Edition J) B5N
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(54) Manufacturing a rigid foam board

(57) A rigid polymeric insulating foam board 1 comprising a first substrate 2, a second substrate 3 and a rigid foam layer 4 sandwiched between the substrates 2,3 is manufactured by leading one substrate 2 over a conveyor and laying down liquid foam reactants onto the substrate through an applicator nozzle 20 which is movable across the substrate 2. The second substrate 3 is applied over the liquid foam reactants through a mangle roller 30 which is height adjustable to produce a foam core of desired thickness. The sides of the mangle roller 30 are independently adjustable to provide a tapered foam core, if desired. The substrates 2, 3 with liquid foam reactants are then passed into an oven before the reactants expand by a free rise technique.

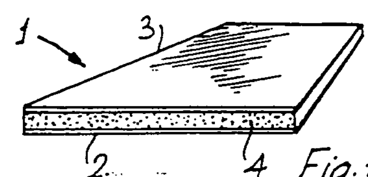

Fig. 10

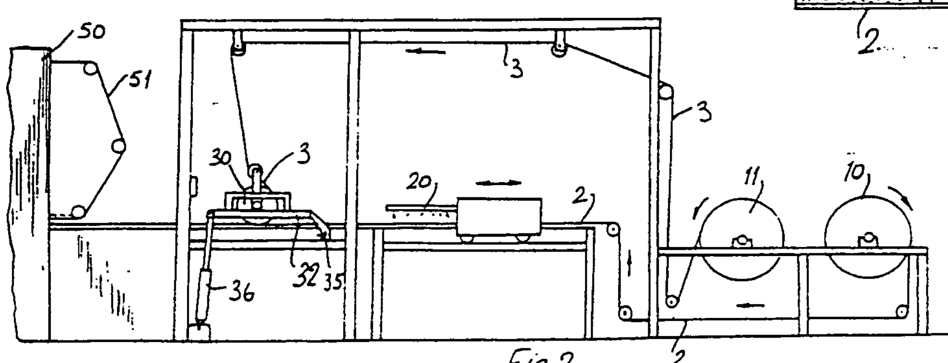

Fig. 2

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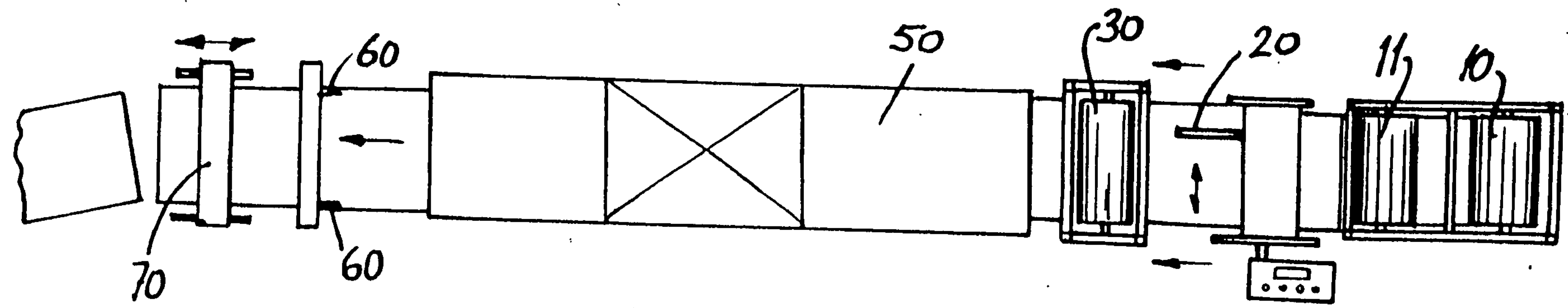

Fig.1

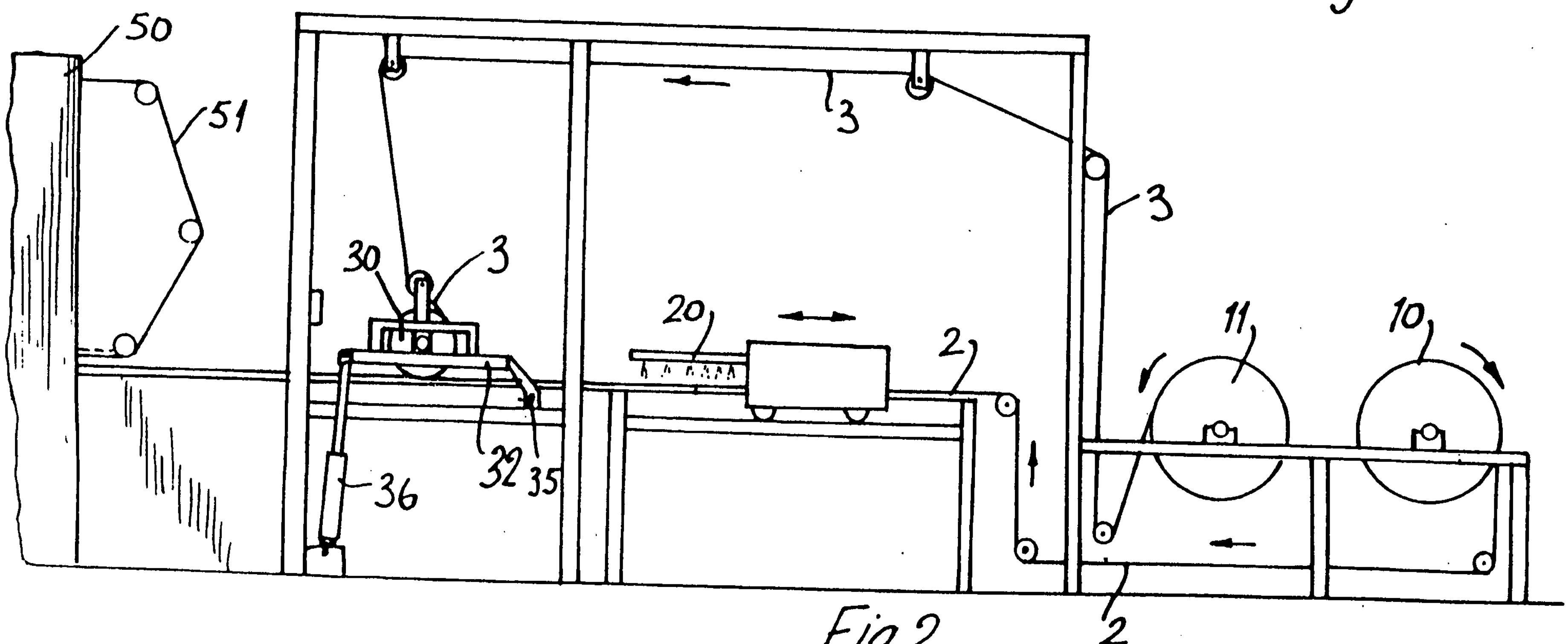

Fig.2

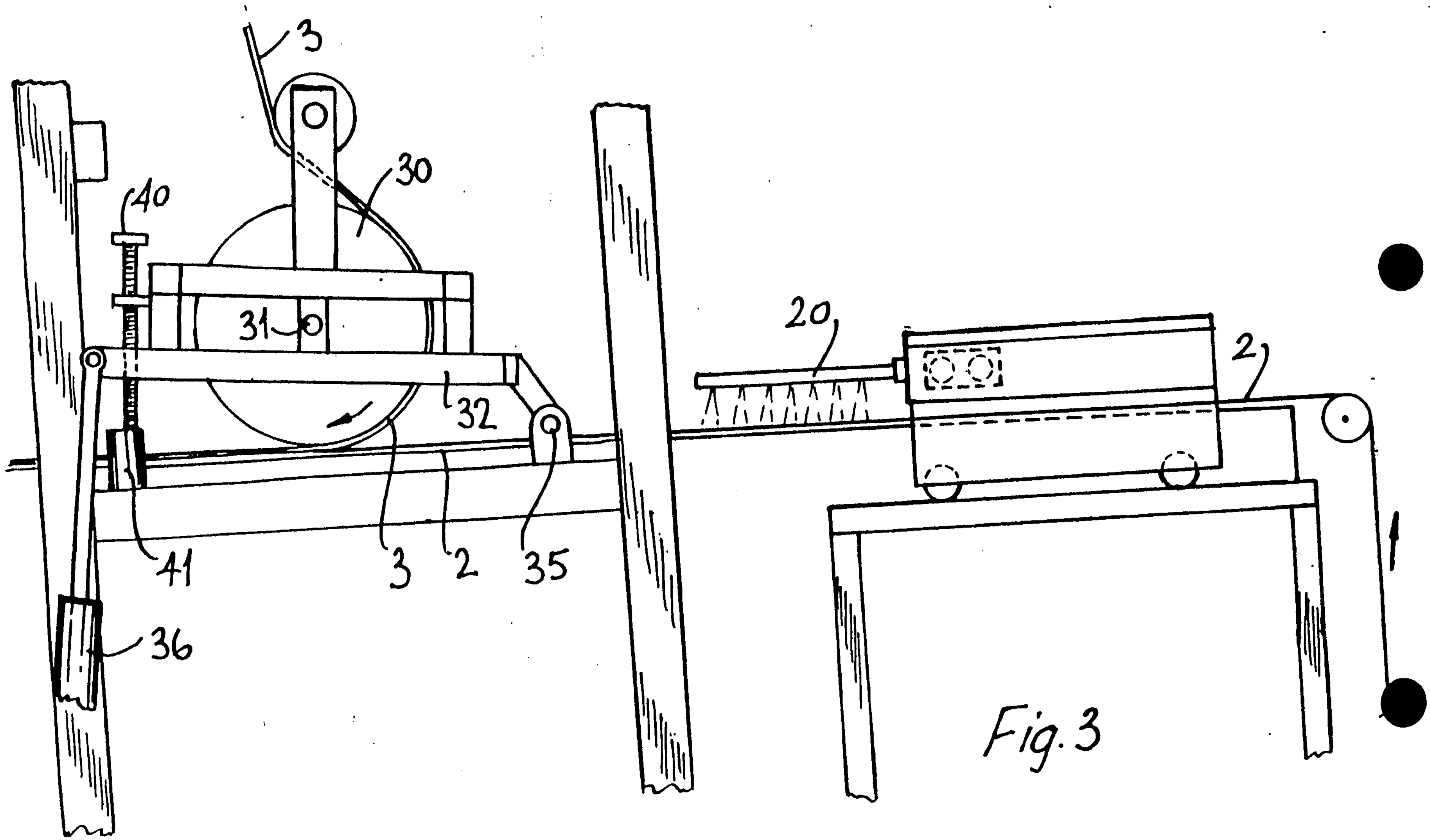

Fig. 3

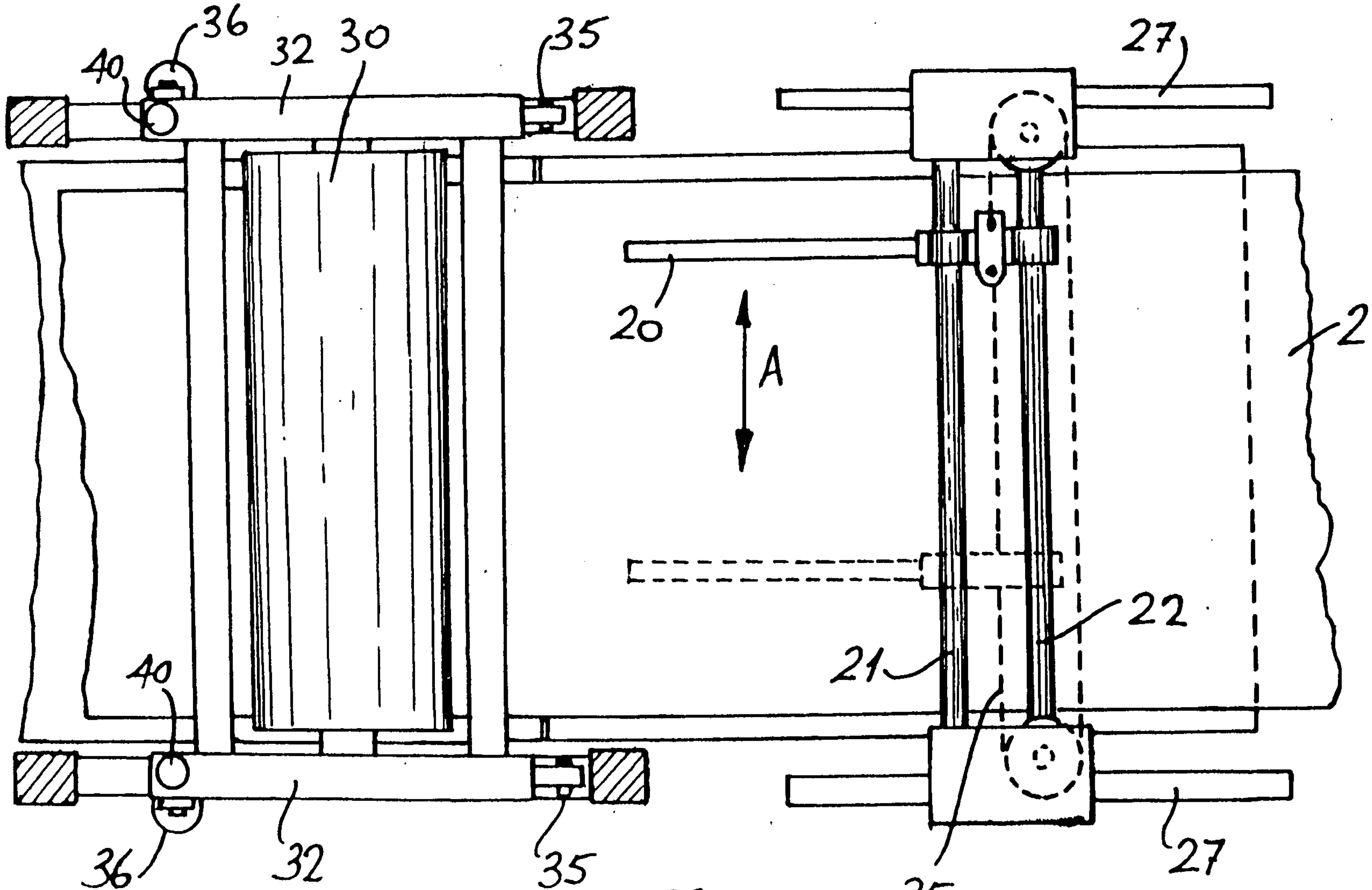

Fig.4

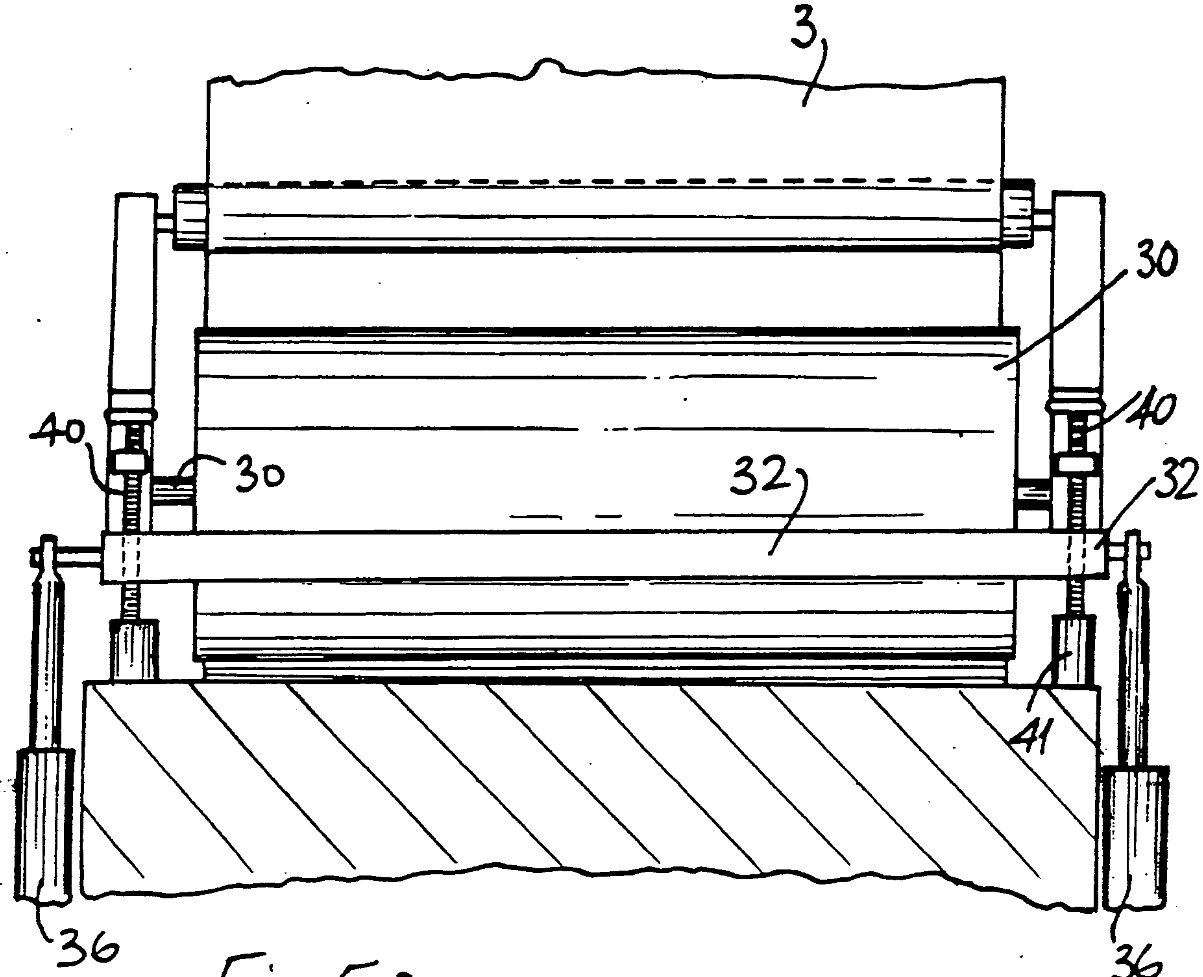

Fig. 5a

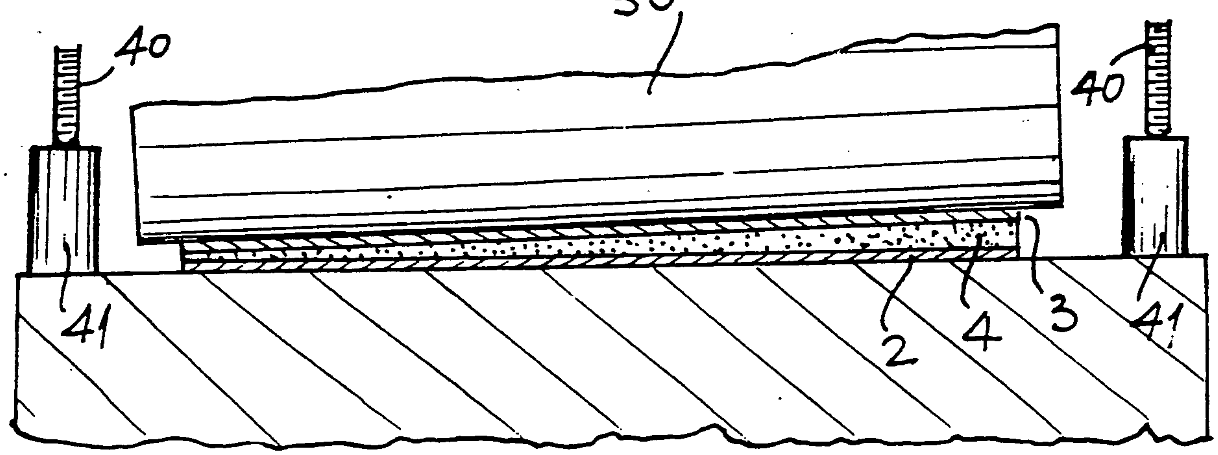

Fig. 5b

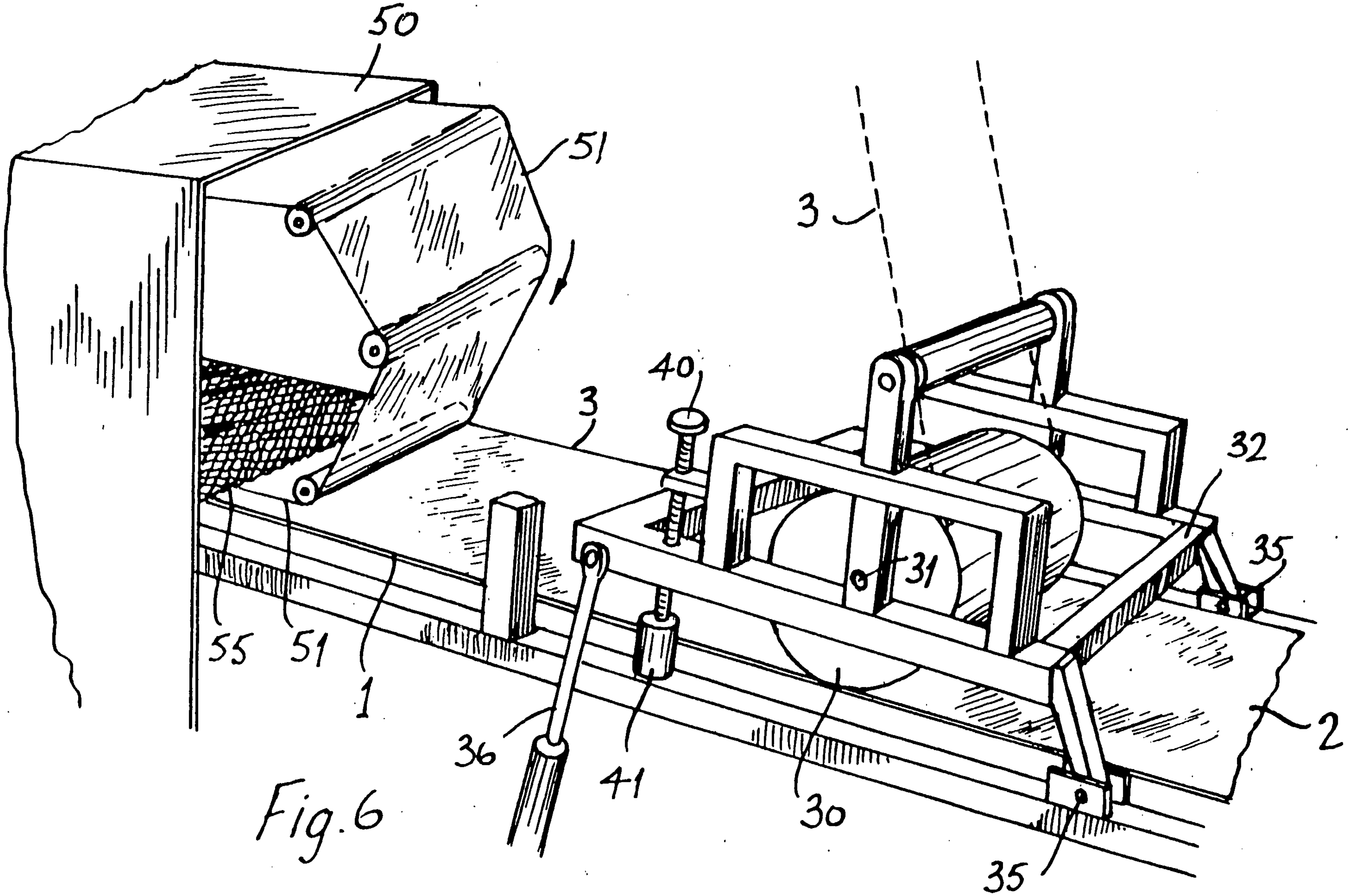

Fig.6

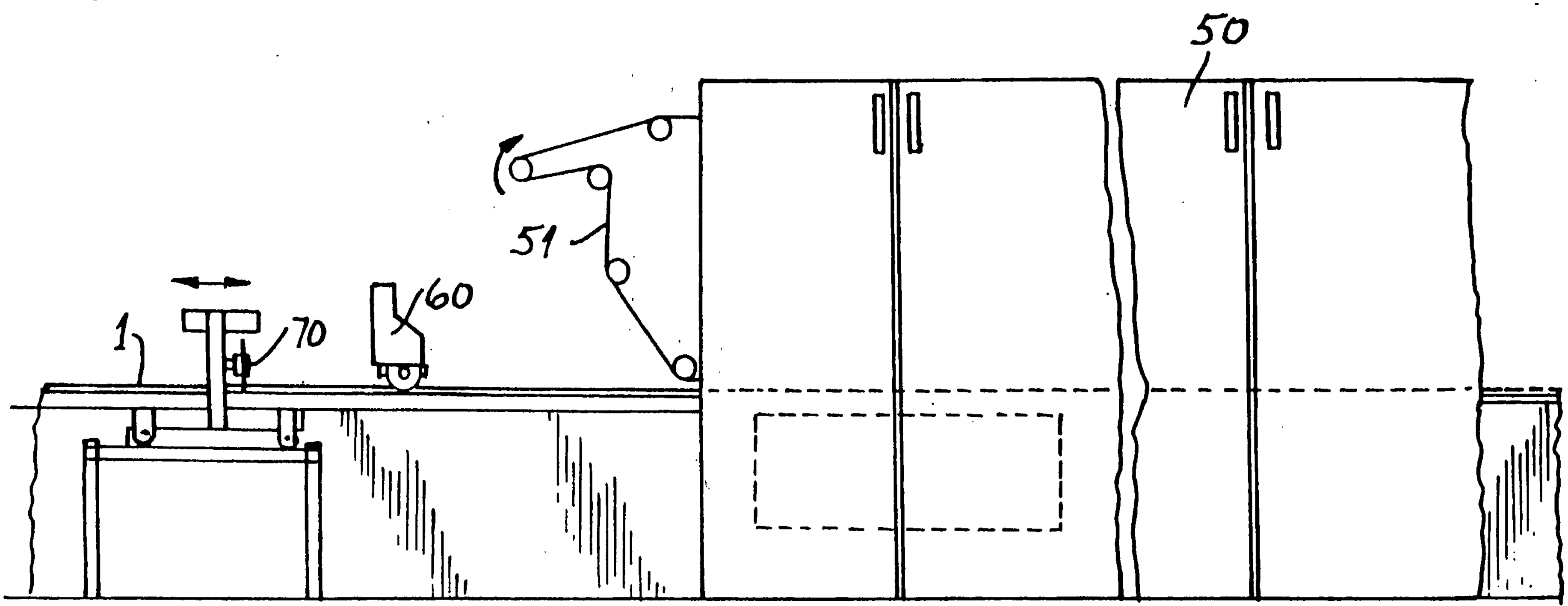

Fig.8

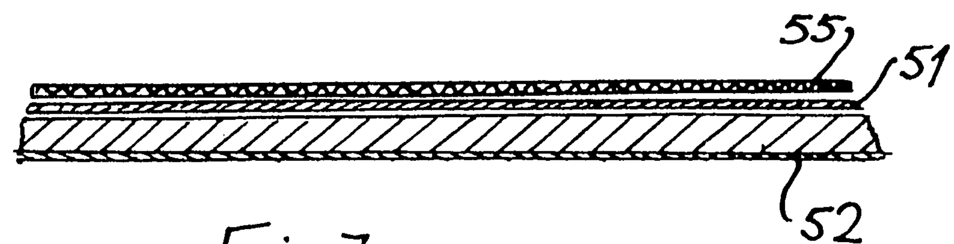

Fig.7

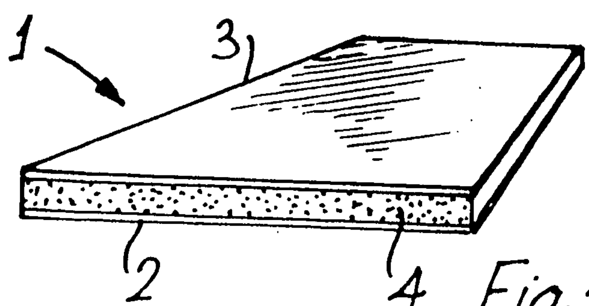

Fig. 10

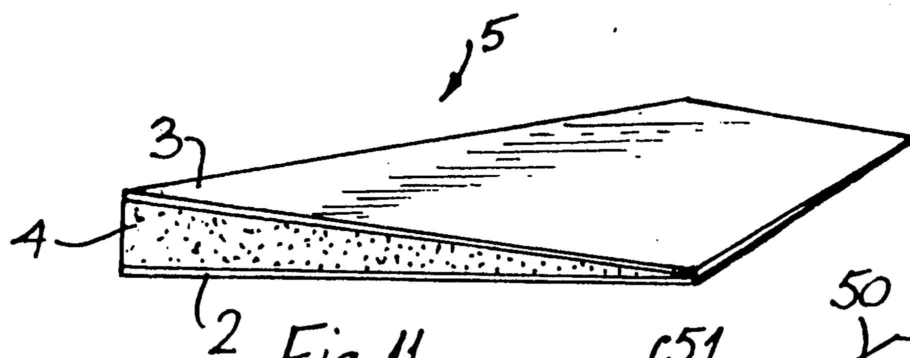

Fig. 11

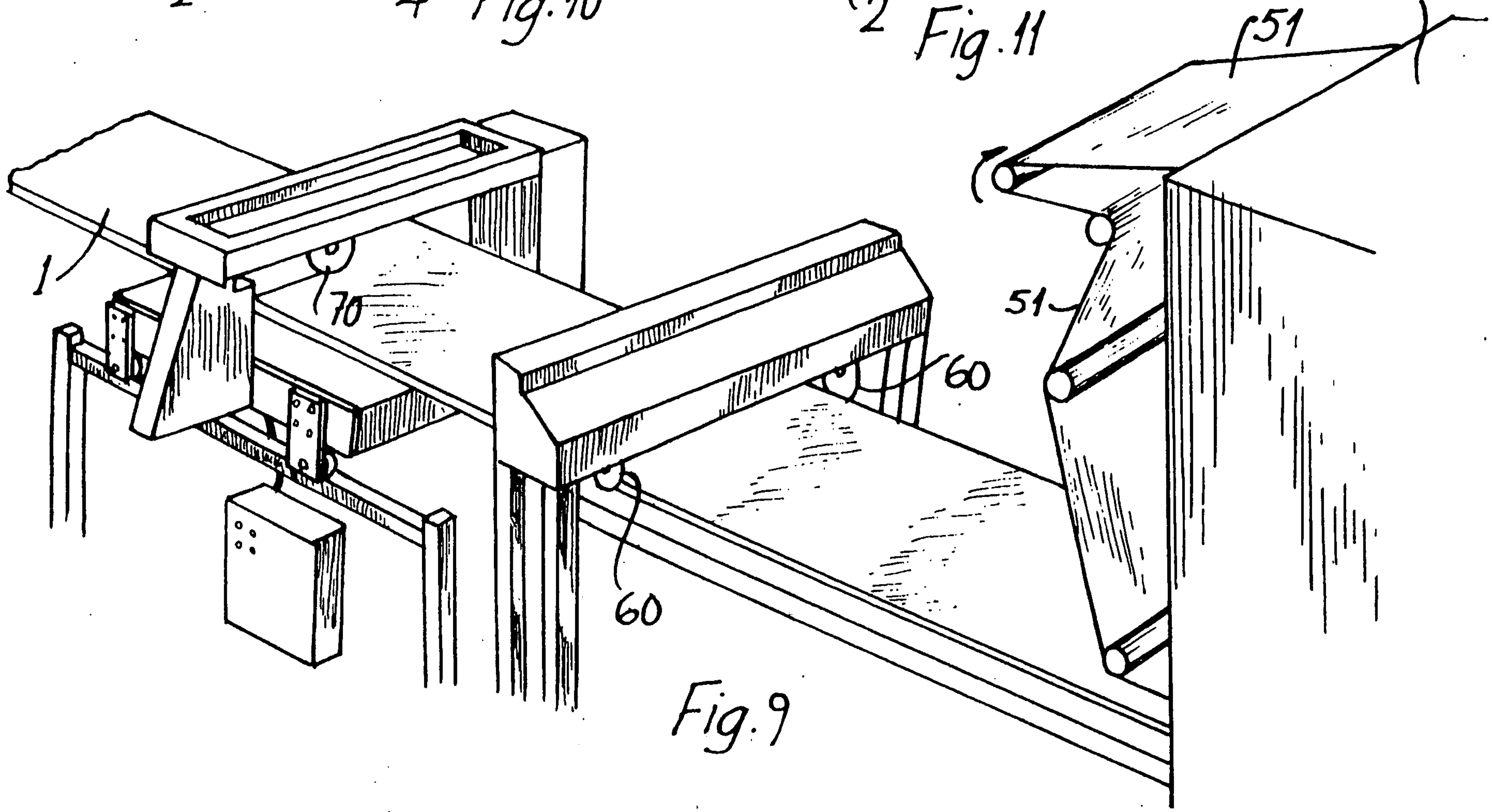

Fig. 9

A method for manufacturing a rigid foam board

The invention relates to a method for manufacturing a rigid polymeric insulating foam board of the type comprising a first substrate, a second substrate and a foam layer between the substrates. Such boards are typically used in the construction of walls, ceilings, roofs or the like.

According to the invention there is provided a method of manufacturing such boards, the method comprising the steps of:

conveying a first substrate continuously along a flat bed,

applying fluid foam reactants onto the first substrate,

continuously applying a second substrate over the liquid foam and the first substrate,

heating the substrates and foam reactants in an oven to allow the foam to freely rise, and

cutting the foam board to a desired length.

In a particularly preferred embodiment of the invention the liquid foam reactants are applied to the first substrate through an applicator nozzle which moves across the substrate to evenly apply the foam reactants onto the substrate.

In a preferred embodiment of the invention the applicator nozzle is slidably mounted on a track for movement across the substrate to apply and spread the liquid foam reactants.

In a preferred embodiment of the invention the second substrate is applied continuously by passing it under a mangle roller which is preset to a desired thickness of foam.

Preferably the marginal longitudinal edges of the substrate are bonded to confine the foam therebetween.

Typically the edges are adhesively bonded.

In a preferred embodiment of the invention the bonded side edges of the substrates are cut longitudinally prior to cutting of the foam board to a desired length.

Preferably the edges are cut by two edge saws through which the board is led.

Typically the edge saws are adjustably mounted to trim the foam board to a desired width.

In a particulary preferred embodiment of the invention the mangle roller is height adjustable.

Preferably the height of the mangle roller is adjusted to provide a board which is tapered in transverse cross section.

In a preferred embodiment of the invention the mangle is rotably mounted in a frame which is pivotally mounted to a bed at one end and is mounted to the bed at the other end by a height adjustable ram means.

Preferably means are provided for setting the gap between the substrates at both sides of the mangle roller.

In a preferred embodiment of the invention stop means are provided for setting the thickness of the foam board at the mangle roller.

In one embodiment of the invention substrate and liquid foam reactants are passed through an oven between two continuous conveyor belts, the spacing between the conveyor belts being set to permit a desired rise of foam as the board passes through the oven.

In a preferred embodiment of the invention means are provided for weighing down the upper of the two conveyor belts.

In one embodiment of the invention the uppermost of the conveyor rollers is weighed down by a metal mesh material extending across the conveyor.

The invention also provides a rigid polymeric insulating foam board made by the method of the invention. Such a board may be either of substantially rectilinear shape in transverse cross section or in some cases may be of tapered configuration in transverse cross section.

The invention will be more clearly understood from the following description of the method thereof given by way of example only with reference to the accompanying

drawings which are diagrammatic views of the method of the invention in which:

Fig. 1 is a plan view of the method of the invention,

Fig. 2 is a side view of a first stage of the method of the invention,

Fig. 3 is an enlarged side view of portion of Fig. 2,

Fig. 4 is a plan view of the portion of Fig. 3,

Fig. 5A is a front elevational view of a mangle roller portion of the invention,

Fig. 5B is an enlarged front cross sectional view of the portion of Fig. 5A,

Fig. 6 is a perspective view of the mangle roller portion of the method,

Fig. 7 is a diagrammatic cross sectional view of another part of the method,

Fig. 8 is a side view of a heating and cutting part of the method,

Fig. 9 is a perspective view of a cutting part of the method, and

Figs. 10 and 11 are perspective views of portions of foam board made by the method according to the invention.

Referring to the drawings there is illustrated a method for manufacturing a rigid polymeric insulating foam board according to the invention. A typical rigid foam board is illustrated in Fig. 10 and indicated generally by the reference numeral 1. The foam board 1 comprises a first or lower substrate 2, a second or upper substrate 3 and a polymeric insulating foam layer 4 sandwiched between the substrates 2, 3. In the case of the board 1 illustrated in Fig. 10 the board is of substantially rectilinear shape in transverse cross section. Another board indicated generally by the reference numeral 5 in Fig. 11 is similar to the board illustrated in Fig. 10 and like parts assigned the same reference numeral. In this case the board 5 is of substantially tapered configuration in transverse cross section.

The first and second substrates 2, 3 may be of any suitable desired materials and may each comprise one, two or indeed more layers as desired. For example, the substrates may be of a glass fibre material, of clear

coated aluminium foil material with or without an intermediate polyethylene liner. One or more of the substrates may be faced for example with plaster board and/or hardboard. The foam core may be of any suitable foam material such as an isocyanurate foam or a polyurethane foam material. In the particular example illustrated in the drawings, the substrates 2, 3 are both of aluminium foil material which are fed from stock reels 10, 11 respectively as illustrated in Figs. 1 and 2.

The lower substrate 2 is led up from the reel 10 over a continuous conveyor and liquid foam reactants from a supply (not shown) are laid down onto the substrate 2 through an applicator nozzle 20 which is slidably mounted on tracks defined by a pair of spaced-apart round bars 21, 22 (see Fig. 4) and is movable by a motor driven mechanism through a chain arrangement 25 which pulls the nozzle head 20 across the lower substrate 2 in the direction of the arrows A in Fig. 4 to evenly distribute the liquid foam reactants on the substrate 2. The tracks are in turn adjustable on side rails 27 for desired lay down of the liquid foam reactants onto the lower substrate 2. The upper substrate 3 is led from the reel 11 over a series of guide rollers and onto a mangle roller 30.

The mangle roller 30 is rotatably mounted in bearings 31 on a frame 32 as illustrated in Fig. 6. The frame 32 is

pivotally mounted at a front end thereof in pivot mountings 35 and is carried at its other end by a pair of height adjustable rams 36 which in turn are mounted to the bed of the machine. Means for setting the height of the roller 30 above the substrate 2 and hence for setting the thickness of the foam board produced by the method of the invention is in this case provided by a pair of setting screws 40, one on each side of the frame 32 which are rotatably mounted in the frame and extend to engage a seat 41 carried by the bed of the machine. To adjust the height of the roller 30 the screws 40 are screwed downwardly or upwardly as required. Means (not shown) are provided for sensing and displaying the height of the roller above the substrate 2 to facilitate adjustment of the roller 30 to a desired level.

To produce a rigid foam board of the type illustrated in Fig. 10 the roller 30 is set at the same height on both sides of the substrate 2. On the other hand, to produce a tapered board of the type illustrated in Fig. 11, the roller 30 is positioned so that there is a greater gap between the lowermost edge of the roller and the uppermost edge of the substrate 2 on one side than on the other side of the substrate 2. The setting for the roller 30 for a tapered board is illustrated in Figs. 5A and 5B.

It will be noted that the liquid foam reactants are laid down on the lower substrate 2 just before the top substrate 3, comes into contact with the foam. The top substrate 3 is fed downwardly and around the mangle roller 30 which is set to provide a spacing between the upper and lower substrate 2, 3 so that only the desired amount of foam reactant mixture for the particular board thickness desired is passed underneath the roller 30. The distance between the roller 30 and the lower substrate 2 is calculated to distribute the liquid foam reactant mixture evenly over the substrates at such a thickness to produce a foam core of desired thickness. Typically the depth allowed for liquid foam reactant mixture is about two to four percent of the final thickness of the foam desired in the final board allowed although this will vary depending on the particular type of foam reactant mixture used.

To confine the liquid foam reactants between the substrates 2, 3 the longitudinal marginal edges of the substrates are bonded together by an adhesive bonding material which is laid down on the bottom substrate 2 and the longitudinal marginal edges of the upper substrate 3 is then applied to the adhesive, for example, by passing it under clamping rollers (not shown).

The sandwich defined by the lower substrate 2, upper substrate 3 and the liquid foam reactants are passed

underneath the mangle roller 30 into an oven 50 where the foam expands to provide a rigid foam board having a thickness of foam of desired depth as set by the setting for the roller 30 and the residence time and temperature in the oven 50. Within the oven 50 are an upper conveyor belt 51 and a lower conveyor belt 52 along which the sandwich of the substrates 2, 3 and foam pass. The arrangement of the conveyors 51, 52 in the oven is such as to allow the liquid foam reactants to expand due to the heat in the oven by a free rise technique. Thus, the spacing between the top surface of the bottom belt 52 and the bottom surface of the top belt 51 is set at the desired thickness of the final rigid foam board. The upper belt 51 is in this case, weighted by a metal mesh 55 resting on the upper side of the upper conveyor belt 51.

The rigid insulating foam board 1 emerging from the oven 50 is cut by two edge saws 60 which trim the longitudinal edges of the foam board and are adjustable to a desired width of board. The board is then cut to size by a reciprocating cross-cut saw 70 which travels with the board as it is passing along the conveyor to cut it to the desired size.

The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail.

CLAIMS

1. A method for manufacturing a rigid polymeric insulating foam board of the type comprising a first substrate, a second substrate and a foam layer between the substrates, the method comprising the steps of:

conveying a first substrate continuously along a flat bed,

applying fluid foam reactants onto the first substrate,

continuously applying a second substrate over the liquid foam and the first substrate,

heating the substrates and foam reactants in an oven to allow the foam to freely rise, and

cutting the foam board to a desired length.

2. A method as claimed in claim 1 wherein the liquid foam reactants are applied to the first substrate through an applicator nozzle which moves across the substrate to evenly apply the foam reactants onto the substrate.

3. A method as claimed in claim 2 wherein the applicator nozzle is slidably mounted on a track for movement across the substrate to apply and spread the liquid foam reactants.

4. A method as claimed in any of claims 1 to 3 wherein the second substrate is applied continuously by passing it under a mangle roller which is preset to a desired thickness of foam.

5. A method as claimed in any of claims 1 to 4 wherein the marginal longitudinal edges of the substrate are bonded to confine the foam therebetween.

6. A method as claimed in claim 5 wherein the side edges are adhesively bonded.

7. A method as claimed in claim 5 or 6 wherein the bonded side edges of the substrates are cut longitudinally prior to cutting of the foam board to a desired length.

8. A method as claimed in claim 7 wherein the edges are cut by two edge saws through which the board is led.

9. A method as claimed in claim 8 wherein the edge saws are adjustably mounted to trim the foam board to a desired width.

10. A method as claimed in any of claims 4 to 9 wherein the mangle roller is height adjustable.

11. A method as claimed in claim 10 wherein the height of the mangle roller is adjusted to provide a board which is tapered in transverse cross section.

12. A method as claimed in claim 10 or 11 wherein the mangle roller is rotatably mounted in a frame which is pivotally mounted to a bed at one end and is mounted to the bed at the other end by a height adjustable ram means.

13. A method as claimed in claim 12 wherein means are provided for setting the gap between the substrates at both sides of the mangle roller.

14. A method as claimed in claim 13 wherein stop means are provided for setting the thickness of the foam board at the mangle roller.

15. A method as claimed in any preceding claim wherein the substrate and liquid foam reactants are passed through an oven between two continuous conveyor belts, the spacing between the conveyor belts being set to permit a desired rise of foam as the board passes through the oven.

16. A method as claimed in claim 15 wherein means are provided for weighing down the upper of the two conveyor belts.

17. A method as claimed in claim 16 wherein the uppermost of the conveyor rollers is weighed down by a metal mesh material extending across the conveyor.

18. A method substantially as hereinbefore described with reference to the accompanying drawings.

19. A rigid polymeric insulating foam board whenever made by the method of any preceding claim.

20. A board as claimed in claim 19 which is of substantially rectilinear shape in transverse cross section.

21. A board as claimed in claim 19 which is of tapered configuration in transverse cross section.

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